LAKE HURON

INDEX FISHING PROGRAM,

1986

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ABSTRACT

Monitoring of relative abundance of pre-recruit lake whitefish, bloater (chub), and yellow perch was continued in several areas of Lake Huron during 1986. In the central and southern portions of the Huron basin itself, graded mesh index gillnetting was performed in both June and September, providing information on all three commercial species. Index gillnetting for lake trout backcross in southern Georgian Bay in August also permitted assessment of whitefish, chub and perch stocks. North Channel populations of lake whitefish and yellow perch were studied through index gillnetting operations begun during July and August 1986 at Blind River and Clapperton Island. The larval cohort of lake whitefish in east-central Lake Huron was also monitored, as has been done since 1978.

In the main basin of Lake Huron, the strong 1982 year class of lake whitefish has been followed by apparently weaker 1983 and 1984 cohorts. The contrast was especially sharp in southern Lake Huron. In southern Georgian Bay, the 1982 whitefish year class was clearly much stronger than other cohorts.

Strong year classes of bloater chub were produced in 1982 and 1984 in the Huron basin, and in 1983 in southern Georgian Bay.

In all three basins of the lake, a very strong year class of perch was produced in 1983. The 1981 and 1982 cohorts were evidently also strong in southern Lake Huron.

The abundance of burbot continued to rise in Lake Huron and Georgian Bay, with implications for competition with other predators, predation on stocked trout, and diversion of lamprey attacks from other host species.

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INTRODUCTION

The Lake Huron Fisheries Assessment Unit (LHFAU) index fishing program provides forecasts of recruitment of commercial species, and monitors changes in the fish community. Year class indices for pre-recruit cohorts of commercial species are an integral part of the LHFAU's program to produce recommendations for fishing quotas based on estimates of exploitable stock biomass plus forecasts of recruitment to the fishery. Fishing returns submitted by commercial fishermen, and catch sampling of the commercial fishery are the other components of the quota review process.

The index fishing program consists primarily of annual graded-mesh gillnetting projects in selected areas of the lake, plus one larval fish trawling project in east-central Lake Huron. The latter operation is intended to yield an early (and approximate) indication of lake whitefish year class strength in the Fishing Islands area. Gillnetting projects produce more precise predictions of year class contributions to the whitefish, chub and yellow perch fisheries within one to three years of recruitment.

Standardized larval fish trawling in the Fishing Islands/Stokes Bay area of east-central Lake Huron has been carried out each spring since 1978. Index gillnetting in the same area started in 1981, and the southern Lake Huron project was added in 1984. Following initial attempts in 1981 and 1983, index fishing was conducted at two locations in the North Channel during 1986. A separate index gillnetting program for splake and lake trout backcross in southern Georgian Bay (performed annually since 1973) also provides information on lake whitefish, chub, perch and other species.

Additional information on pre-recruit bloater (chub) in southern lake

Huron has been obtained courtesy of the United States Fish and Wildlife Service (USFWS) who have carried out bottom trawling surveys near Goderich since 1981, with LHFAU samplers on board to collect chub sample data.

Results from the 1986 fishing operations are presented in this report, and discussed with regard to fishery projections for 1987 and 1988. Results from previous years were presented in Hughes (1982; 1984; 1986a); detailed summaries from 1986 operations in the North Channel were compiled in Hughes (1986b; 1986c).

METHODS

Larval fish trawling was carried out two days per week from April 21 to June 5, 1986. Twenty-five tows were made each week, at eight sites from Stokes Bay south to Oliphant on the Lake Huron shore of the Bruce Peninsula. Each involved towing a conical net measuring 0.8 m in diameter and 3 m in length (mesh size 500 µm) at the surface alongside a 4.9 m skiff at an estimated speed of 0.7 m sec^{-1} for a duration of 5 minutes. A flowmeter suspended in the net aperture permitted calculation of water volume filtered and effective tow velocity. Any larval fish caught were preserved immediately in 10% formalin and later transferred to 70% ethanol. All specimens were identified and counted, and total length measurements were recorded for a subsample of 30 of each species per sample. Further descriptions of the gear and methods were presented by Loftus (1982).

Index gillnet gangs consisted of eight panels of two-strand nylon nets of mesh sizes 38, 51, 64, 76, 89, 102, 114, and 127 mm (1.5 to 5.0 inches by 0.5 inch increments). The 38 mm panels were 46 m long, and all others were 91 m long, for a total gang length of 686 m (750 yd). Panels were connected in order of mesh size. Two nets were fished daily, set parallel to each other about 500 m apart, in opposing sequence of mesh size. Set

orientation was usually perpendicular to shore.

For the southern Georgian Bay index program (backcross assessment), the gangs were doubled; i.e., each gang consisted of two complete sequences of mesh size. Also, set orientation alternated daily between parallel and perpendicular to shore. Gillnet composition also differed for the perch netting at Clapperton Island, where only mesh sizes up to 76 mm (3.0 inches) were used, and for backcross assessment at Heywood Island, where four additional mesh sizes were included: 25, 32, 44 and 56 mm. At the latter location, only one gang was fished daily (see Hughes, 1986b).

Table 1 outlines the various projects that make up the index fishing program on Lake Huron. The June gillnetting in central and southern Lake Huron is divided into three depth strata. In remaining times and places, fishing effort is directed at temperature strata of about 12 C for lake whitefish (and backcross) and 16-20 C for yellow perch. Fishing in both June and September in southern Lake Huron (as begun in 1986) is expected to continue as the standard operation there. The USFWS trawls are made at fixed depths from 27 to 73 m (15 to 40 fathoms at 5 fathom intervals).

Gillnet lifts and sets were conducted daily during index projects, with resulting set durations of 20-22 hours, except for occasional two-night sets when winds prevented tug operation. For calculation of catch per unit effort (CUE), two-night sets were treated as 2 one-night sets combined. Catch data from 38 mm mesh size panels were doubled to correct for the shorter panel length when compiling age distributions. Gillnet CUEs were expressed as numbers per 1000 m of gillnet per night.

Intensive sampling was performed on coregonine, salmonine and percid species, and comprised measurements of fork length, total length and round weight, examination for sex, gonad development and lamprey marks, and removal of scales for age interpretation. Contents of salmonine stomachs were also recorded, as well as any fin clips on salmonine specimens. In

Table 1. Current structure of the index fishing program on Lake Huron.

Basin & Location	Month	1986 Effort(yd)	Species covered	Years Fished
Huron				
Oliphant	June	13,500	whitefish, chub, perch	1981-86
	Sept.	13,500	whitefish, chub, perch	1982-86
Grand Bend & Bayfield	June	13,500	whitefish, chub, perch	1985-86
	Sept.	6,000	whitefish,(chub, perch)*	1984; '86
Goderich (USFWS trawls)	April/May	nil	chub	1981-85
	Oct./Nov.	6 tows	chub	1981-86
Georgian Bay				
Cape Rich	Aug.	30,000	backcross (whitefish, chub, perch)*	1973-86
Owen Sound	Aug.	12,000	backcross (whitefish, chub, perch)*	1984-86
North Channel				
Heywood Island	Aug.	12,400	backcross	1981; '83-86
Blind River	July/Aug.	6,400	whitefish	1981; '86
Clapperton I.	Aug.	3,200	perch	1986

* Species in parentheses are not targeted by the fishing effort, but are caught incidentally.

cases of large catches of perch or chub per single mesh size panel, sampling was carried out on a random sample of 30 or 50, respectively, in each mesh panel. All burbot were sampled, primarily for size data and stomach contents. Suckers, smelt, alewives, etc., were usually subsampled for length tally only.

RESULTS

Larval fish trawling

Larval CUEs by species at the five sampling locations in 1986 are presented in Table 2. Whitefish CUEs were much higher at all sites except Oliphant than in any previous year since sampling began in 1978. The Oliphant CUE was second only to the 1985 catch rate at that site. Lake herring CUEs were much lower than those for whitefish, but higher than in the past two years. Catches of perch were very low, especially at Pike Bay where most larval perch have been caught in other years.

Table 3 shows the 1978-1986 summary of larval fish CUEs for the overall monitoring area. The whitefish CUE was well above that for any other year, while the herring CUE was not much above the average for the preceding years. The catch rate for perch was less than half the previous low observed in 1984. Larval burbot showed a pronounced increase in 1986, jumping from the 0.4-4.1 range to 43.0 fish per 1000 m^3. Burbot abundance is discussed at more length later in this report.

Larval lake whitefish indices are compiled in Table 4. Almost all of the large catch of whitefish was composed of specimens <16 mm long. The number >16 mm long was third behind 1983 and 1980. Year class strength for the 1986 cohort is expected to be very good. Comparison of larval whitefish indices with index gillnet indices is presented in the discussion

Table 2. Larval fish CUEs (no/1000 m^3) from the Fishing Islands area, 1986.

Species	Stokes Bay	Pike Bay	Howdenvale	Red Bay	Oliphant	Area Total
lake whitefish	724.9	1,033.6	1,377.5	849.9	85.7	827.9
lake herring	20.2	34.7	22.9	7.7	2.8	21.0
round whitefish	-	0.2	-	0.3	-	0.1
rainbow smelt	1.2	9.0	0.5	-	2.8	3.3
white sucker	0.2	-	-	-	-	0.1
carp	0.4	-	-	-	-	0.1
burbot	19.6	8.3	126.6	116.2	37.3	43.0
yellow perch	223.6	120.9	56.8	34.3	11.2	126.6
deepwater sculpin	-	-	-	-	0.4	<0.1
Total CUE	990.1	1,206.6	1,584.3	1,008.4	140.2	1,022.1
Number of tows	63	49	21	21	21	175
Total no. caught	6,278	6,379	3,786	2,769	331	19,543

Table 3. Summary of larval fish CUEs in the Fishing Islands area, 1978-1986.

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986
alewife	-	-	-	0.3	-	-	0.2	-	-
coregonine sp.	-	0.4	-	-	-	-	-	-	-
lake whitefish	44.4	76.6	103.2	84.8	13.6	172.4	176.3	150.1	827.9
lake herring	24.8	6.2	8.0	30.6	11.7	39.8	3.3	3.7	21.0
round whitefish	-	0.1	-	-	-	-	-	-	0.1
rainbow smelt	1.6	0.2	0.6	1.4	5.5	8.1	0.5	8.1	3.3
white sucker	0.5	0.4	-	-	-	-	<0.1	<0.1	0.1
cyprinid sp.	0.7	-	-	-	-	-	-	0.1	-
carp	29.2	0.1	-	-	-	-	-	<0.1	0.1
golden shiner	<0.1	-	-	-	-	-	-	-	-
burbot	1.1	1.4	0.4	1.2	4.1	1.1	1.1	1.5	43.0
crappie sp.	-	-	-	-	0.1	-	-	-	-
smallmouth bass	<0.1	-	-	-	-	-	-	-	-
yellow perch	948.8	1134.5	546.6	536.6	537.2	452.9	309.1	1101.5	126.6
deepwater sculpin	0.1	0.1	<0.1	<0.1	0.1	0.4	0.3	0.1	<0.1
Total CUE:	1050	1220	659	656	573	675	491	1265	1022
No. of tows:	170	196	173	191	184	210	191	198	175
Total no. caught:	18,650	19,267	12,933	12,777	10,015	15,340	7,790	23,362	19,543

Note: Larval trawling in 1978-1981 continued throughout June, but only data up to June 10 are included here to make the CUEs comparable to the 1982-1986 data.

Table 4. Larval lake whitefish indices, 1977-1986, from the Fishing Islands area.

Year	Total CUE	Number caught	Number <16 mm	Number >16 mm	Number >20 mm
1977	-	-	-	-	31
1978	44.4	820	738	82	8
1979	76.6	1,279	1,123	156	2
1980	103.2	2,058	1,129	929	55
1981	84.8	1,740	1,456	284	4
1982	13.6	259	214	45	5
1983	172.4	3,947	2,925	1,022	1
1984	176.3	2,632	2,361	271	0
1985	150.1	2,929	2,864	65	6
1986	827.9	16,103	15,303	800	9

Table 5. Larval lake herring indices, 1977-1986, from the Fishing Islands area.

Year	Total CUE	Number caught	Number <16 mm	Number >16 mm	Number >20 mm
1977	-	-	-	-	15
1978	23.6	436	319	117	58
1979	7.4	124	85	39	8
1980	7.5	150	75	75	24
1981	29.3	601	558	43	4
1982	11.8	224	222	2	0
1983	34.2	784	704	80	3
1984	3.3	49	46	3	0
1985	3.7	80	79	1	1
1986	21.0	403	324	79	16

section of this report.

The larval lake herring indices in all size categories (Table 5) suggest an improvement in cohort strength compared with 1984 and 1985.

A major portion of the large catch of lake whitefish (and lake herring) occurred during one week of sampling only. Fairly windy conditions may have affected the catchability of the fish, contributing to the very high CUE for the year. Appendix B shows the weekly length frequency distributions for lake whitefish, lake herring, yellow perch, burbot and rainbow smelt.

Index gillnetting

Catches by mesh size for all 1986 index gillnetting projects are tabulated in Appendix C, while Appendix D contains size-at-age tables for whitefish, chub and perch from index catches. Results presented below include CUEs and age distributions from the various index projects: Oliphant, 1981-1986; Grand Bend/Bayfield, 1984-1986; Cape Rich, 1979-1986; Owen Sound, 1984-1986; Blind River, 1981-1986 (discontinuous); Clapperton Island, 1986; and Heywood Island, 1984-1986.

CUEs from the June and September 1981-1986 index gillnetting projects at Oliphant are compiled in Table 6. Bloater and yellow perch were the predominant species in both 1986 projects, with smelt, burbot and alewife also common in September 1986. CUEs for lake whitefish and smelt in both months, and for alewife in June, were low relative to previous years. No explanation is offered to account for the low catch rates of those species. The burbot catch rates were again higher in 1986, continuing a trend observed since 1982.

Table 7 shows the 1984-1986 index gillnet CUEs from southern Lake Huron. The June catches were dominated by perch and chub, even when the nets were set in typical whitefish depths for that time period (18-30 m).

Table 6. Index gillnetting CUEs (no./1000 m) at Oliphant, 1981-1986. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	1981	1982		1983		1984		1985		1986	
	June	June	Sept.	June	Sept.	June	Sept.	June	Sept.	June	Sept.
sea lamprey	-	-	-	0.1	-	0.1	-	-	-	-	-
alewife	12.3	10.3	12.8	40.9	41.4	37.4	21.7	53.3	98.8	8.4	20.5
gizzard shad	-	-	1.1	-	1.4	-	32.6	-	4.6	-	0.1
pink salmon	-	-	-	-	-	-	-	-	0.3	-	-
coho salmon	0.3	-	-	-	-	-	-	-	-	-	-
chinook salmon	0.4	0.3	0.4	0.1	0.6	0.4	0.5	0.2	0.4	0.1	0.2
rainbow trout	-	-	-	-	0.1	-	-	-	-	-	-
lake trout	0.1	0.2	-	-	0.2	0.1	0.1	0.1	0.4	0.1	-
lake trout backcross	-	-	-	-	-	-	0.2	-	-	-	-
lake whitefish	22.0	9.2	4.6	26.1	31.0	14.7	6.3	14.8	37.5	5.5	9.5
lake herring	6.6	2.6	1.2	11.6	2.4	19.1	1.2	5.3	0.2	1.2	0.4
bloater	73.6	53.9	98.3	65.9	94.0	45.5	60.3	70.5	83.9	41.1	82.5
cisco sp.	2.4	8.4	6.6	22.6	-	29.6	7.5	29.0	-	0.2	0.1
round whitefish	3.3	6.8	16.7	6.5	14.2	3.3	7.7	0.5	10.1	1.5	2.8
rainbow smelt	9.4	4.7	36.5	14.8	137.6	5.2	159.0	1.9	63.7	0.3	27.5
longnose sucker	5.5	2.7	11.7	8.9	40.7	14.4	21.5	10.5	12.4	5.8	11.5
white sucker	1.9	0.6	19.4	-	46.4	2.8	8.8	0.8	7.9	0.1	1.0
redhorse sp.	-	-	-	-	-	-	0.1	-	0.1	-	-
lake chub	-	0.1	3.1	-	0.7	0.2	4.0	-	1.3	-	0.7
carp	-	-	0.1	-	-	-	-	-	-	-	-
channel catfish	-	0.3	0.5	-	0.5	0.6	0.4	0.2	0.5	-	0.2
burbot	-	1.4	0.2	1.8	1.5	3.1	6.8	2.6	14.5	7.0	23.3
9-spine stickleback	-	-	-	0.1	0.1	-	-	-	-	-	-
white bass	-	-	-	-	-	-	0.1	-	-	-	-
rock bass	-	-	-	-	-	-	0.2	-	1.0	-	0.1
smallmouth bass	-	-	-	-	0.1	-	0.6	-	0.5	-	-
yellow perch	1.4	0.5	33.6	1.4	56.7	2.8	40.0	37.0	124.1	37.3	121.0
walleye	-	-	-	-	0.1	-	0.1	-	-	-	-
freshwater drum	-	-	-	-	-	-	-	-	0.1	-	-
sculpin sp.	-	-	-	-	0.1	-	-	-	-	-	-
Total CUE	138.9	101.6	246.5	200.6	469.6	179.4	379.6	226.7	462.3	108.5	301.4
Effort (X 1000 m)	10.97	12.31	10.96	10.96	10.91	12.34	12.34	10.97	10.97	12.34	12.34

Table 7. Index gillnetting CUE's (no/1000 m) in southern Lake Huron, 1984 - 1986. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	Fall 1984	Spring 1985	Spring 1986	Fall 1986
sea lamprey	0.1	-	-	-
alewife	0.5	15.2	4.9	3.3
gizzard shad	0.3	2.2	-	4.0
salmon sp.	0.2	-	-	-
coho salmon	0.3	-	0.2	-
chinook salmon	6.8	0.6	0.4	4.2
lake trout	0.1	0.3	0.3	0.7
lake whitefish	9.7	12.3	1.9	34.6
lake herring	0.2	0.8	0.1	-
bloater	87.2	37.5	109.1	16.2
cisco sp.	-	79.4	-	-
rainbow smelt	25.2	16.2	9.1	182.6
longnose sucker	1.1	38.5	2.0	-
white sucker	10.4	10.8	1.4	0.4
lake chub	-	0.4	-	-
brown bullhead	-	0.4	-	-
channel catfish	0.4	0.1	-	-
burbot	0.9	-	0.4	-
trout-perch	0.1	-	-	-
white bass	0.1	-	-	-
yellow perch	84.8	80.3	110.1	12.4
walleye	1.1	-	-	0.9
freshwater drum	0.3	0.1	-	-
sculpin sp.	-	0.1	-	-
Total CUE	229.9	296.0	237.1	259.6
Effort (X 1000 m)	9.60	9.60	12.34	5.49

Whitefish CUEs were very low in June, but were much higher in the fall fishing, when fishing effort was directed only at whitefish (target temperature of 12 C). Poor catches of whitefish can occur seasonally in the south, likely as a result of dispersal on both sides of the border. The total catch in September was predominantly smelt, followed by lake whitefish, chub and perch. Index gillnet CUEs for burbot have been neither high nor increasing in southern Lake Huron.

Cape Rich CUEs are listed in Table 8 for the period 1979-1986. Lake trout backcross, rainbow smelt and white sucker have been most numerous in the catches. CUEs for lake whitefish, chub and perch rose during the past two or three years as a result of single strong year classes (discussed later). Catch rates for burbot have increased in most years since 1979. A detailed report on backcross assessment was presented in Hughes (1987).

Index gillnet catches in Owen Sound bay during 1984-1986 (Table 9) have been composed mainly of backcross, smelt, and both longnose and white suckers. Chub and perch were also prominent in 1986, and burbot CUEs have risen substantially over the three year period.

The CUEs from index gillnetting in the Blind River area of the North Channel (Table 10) do not comprise a valid time series because of the sporadic effort and varying seasons and depth ranges fished. However, the catches have featured considerable numbers of round whitefish and (except in 1986) white suckers. For Clapperton Island in the eastern North Channel, the 1986 CUEs are listed in Table 11. Both North Channel index fishing projects were reported on in some detail in Hughes (1986c).

Table 12 contains the 1984-1986 CUEs from index gillnetting at Heywood Island, eastern North Channel, for lake trout backcross. Smelt and cisco sp. (believed to be bloater chub) have been most prominent in the catches. Burbot have not shown up to any great extent in that area. The results of backcross assessment in this area were previously summarized (Hughes 1986b).

Table 8. Index gillnetting CUEs (no/1000 m) at Cape Rich, 1979-1986. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	1979	1980	1981	1982	1983	1984	1985	1986
sea lamprey	0.02	-	0.02	-	-	0.03	-	0.15
alewife	2.08	5.78	5.59	3.88	17.00	0.06	1.86	2.70
pink salmon	-	-	0.02	-	0.03	-	0.03	-
coho salmon	-	0.05	-	-	-	-	-	-
chinook salmon	0.04	0.21	0.53	0.36	0.52	0.27	0.36	1.31
rainbow trout	-	-	0.12	0.05	0.18	0.18	0.10	0.26
brown trout	-	-	0.02	0.03	-	0.06	-	-
brook trout	-	-	0.02	-	-	-	-	-
lake trout backcross	27.41	76.37	39.50	35.58	33.97	73.29	65.35	69.77
lake whitefish	3.52	8.28	1.48	2.66	1.77	6.07	7.79	4.88
lake herring	0.05	0.10	0.27	0.10	-	0.06	-	-
bloater	3.94	9.35	4.03	8.85	1.82	6.13	32.34	18.19
round whitefish	0.16	0.26	0.17	0.29	0.21	0.39	0.46	0.51
rainbow smelt	42.97	111.28	53.50	83.87	32.72	28.76	60.75	46.33
longnose sucker	4.65	8.56	5.73	8.30	10.91	33.83	16.47	15.27
white sucker	35.44	71.09	110.50	63.52	60.47	85.13	53.16	60.59
lake chub	1.26	1.80	1.43	2.81	2.58	2.13	0.50	1.28
carp	0.02	-	0.02	0.03	-	-	-	-
burbot	0.49	0.89	0.49	2.00	2.52	3.01	4.71	3.50
trout-perch	-	-	-	-	-	0.03	-	-
rock bass	-	-	0.02	-	-	-	-	-
smallmouth bass	0.02	-	-	-	-	-	-	-
yellow perch	0.84	1.56	26.29	4.27	1.25	12.12	19.12	19.65
Total CUE	114.27	295.58	249.78	216.55	165.95	251.46	263.00	244.46
Effort (x 1000 m)	54.86	38.40	41.15	38.40	38.40	32.92	30.18	27.43

Table 9. Index gillnetting CUEs (no/1000 m) at Owen Sound, 1984-1986. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	1984	1985	1986
sea lamprey	-	0.2	-
alewife	0.3	7.2	24.4
chinook salmon	0.3	1.2	0.8
rainbow trout	0.1	0.1	0.1
brown trout	0.5	0.3	0.3
lake trout	-	-	0.1
lake trout backcross	106.9	91.1	75.3
lake trout sp.	-	-	0.1
lake whitefish	7.7	2.8	2.3
bloater	12.0	10.6	53.0
round whitefish	0.5	0.3	0.5
rainbow smelt	47.2	109.1	61.4
longnose sucker	39.4	54.0	32.5
white sucker	28.4	32.4	22.1
lake chub	2.2	3.0	0.8
burbot	13.0	23.4	27.4
yellow perch	8.3	22.3	47.1
Total CUE	266.7	358.1	348.4
Effort (X 1000 m)	10.97	9.60	10.97

Table 10. Index gillnetting CUEs (no/1000 m) at Blind River, 1981 - 1986. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	July 1981	Sept-Oct 1981	June 1983	July-Aug* 1986
sea lamprey	0.1	-	-	-
lake sturgeon	3.1	1.0	7.7	-
alewife	10.5	15.2	12.6	27.0
pink salmon	-	0.5	-	-
chinook salmon	-	-	-	0.4
backcross	0.1	0.1	0.1	0.2
lake whitefish	4.8	5.8	9.8	12.6
lake herring	1.0	1.9	6.4	1.1
bloater	1.1	-	-	-
cisco sp.	0.1	-	-	7.1
round whitefish	17.9	28.3	55.6	31.5
rainbow smelt	41.2	8.6	10.2	14.4
northern pike	-	0.4	-	-
redhorse sp.	-	0.1	-	-
longnose sucker	15.9	0.6	7.8	1.1
white sucker	96.6	34.5	43.7	0.2
lake chub	0.1	0.3	0.2	-
burbot	0.1	0.2	-	0.4
rock bass	-	0.6	-	-
yellow perch	19.7	1.4	15.9	-
walleye	0.2	0.9	0.2	-
Total CUE	212.2	100.9	170.2	95.9
Effort (m)	10.97	9.60	5.49	5.49

* 1986 CUEs exclude catches from 25 mm mesh size, which was not used in 1981 and 1983.

Table 11. CUEs (no/1000 m) from index gillnetting at Clapperton Island, August 1986.

Species	C.U.E.
lake sturgeon	0.3
alewife	5.1
cisco sp.	0.3
rainbow smelt	47.5
northern pike	0.3
white sucker	49.9
lake chub	4.4
spottail shiner	87.5
brown bullhead	0.3
trout-perch	16.1
rock bass	3.8
yellow perch	640.1
sculpin sp.	0.3
Total:	856.1

Table 12. Index gillnetting CUEs (no/1000 m) at Heywood Island, 1984 - 1986. (Not adjusted for shorter panel lengths of 25-44mm meshes.

Species	CUE (no/1000m)		
	1984	1985	1986
alewife	53.8	2.9	23.3
rainbow trout	0.1	-	-
backcross	63.5	51.3	33.5
lake whitefish	0.4	0.1	-
lake herring	5.1	4.9	2.8
cisco sp.	152.8	86.0	123.2
round whitefish	5.4	4.6	6.3
rainbow smelt	393.3	273.1	160.0
longnose sucker	3.5	1.5	2.9
white sucker	22.7	3.8	6.6
lake chub	0.3	-	-
spottail shiner	0.1	-	-
burbot	-	0.1	-
trout-perch	-	0.1	-
rock bass	0.3	-	-
smallmouth bass	0.7	-	-
yellow perch	-	5.3	1.3
sculpin sp.	0.4	0.4	0.4
Total CUE	716.3	437.2	360.3
Effort (1000m)	7.09	11.34	11.34

Age distributions: 1. Lake whitefish

CUEs-at-age for lake whitefish from Oliphant (1981-1986), Grand Bend (1984-1986), Cape Rich (1978-1986) and Blind River (1981-1986) are listed in Tables 13 to 16, respectively. Because of variable catchability, the CUE data are not useful as abundance indices directly (nor for estimating total mortality).

At Oliphant (Table 13), yearling whitefish recruited to the index gear in June 1981, but not until the September fishing in subsequent years. Evidently, growth of age 0-1 whitefish has been slower for cohorts produced after 1980, although back-calculations have not been performed to verify this. The June 1986 catch of whitefish had the highest mean age yet observed (3.3), with ages 3 and 4 dominating. By September, however, recruitment of yearlings dropped the mean age to the second-lowest recorded thus far (1.5). The relative dominance of the 1985 year class in the September 1986 catch suggests an improvement in year class strength over the weaker (but nevertheless good) 1983 and 1984 year classes.

The southern Lake Huron whitefish age distributions (Table 14) show the very strong 1982 cohort dominating the catches until September 1986, when fish from the 1983, 1984 and 1985 year classes contributed more substantially. The representation by the 1982 cohort was still considerable, however.

For Cape Rich (Table 15), whitefish CUE-at-age data from 1978 to 1982 showed the effect of the strong 1977 year class, as mean age increased steadily from 1.7 to 3.3 during that period. Similarly, representation of the strong 1982 year class during 1984 to 1986 caused mean age to rise from 2.4 to 3.8 yr.

As previously mentioned, the inconsistent occurrence of index fishing at Blind River prevents any real interpretation of that data series. The whitefish CUEs-at-age (Table 16) do not reveal much beyond the tendency for

Table 13. CUEs-at-age for lake whitefish from index gillnetting at Oliphant, 1981 - 1986.

Year/Month	Age						Total CUE	Mean Age
	1	2	3	4	5	>5		
1981 June	16.3	14.0	5.5	1.6	0.0	0.0	37.4	1.8
1982 June	2.9	5.1	4.9	1.0	1.2	0.1	15.2	2.5
Sept	7.8	3.2	0.7	0.2	0.0	0.2	12.1	1.4
1983 June	2.7	16.6	12.1	4.4	0.1	0.4	36.3	2.6
Sept	17.8	21.3	13.3	5.0	0.5	0.2	58.1	2.1
1984 June	0.5	10.3	9.3	4.5	0.5	0.0	25.1	2.8
Sept	6.4	5.5	2.2	1.6	0.2	0.2	16.1	2.0
1985 June	3.1	14.4	6.0	5.1	0.5	0.2	27.7	2.5
Sept	16.4	8.7	6.2	1.1	0.5	0.0	32.8	1.8
1986 June	0.5	2.7	5.2	4.8	0.9	0.5	14.6	3.3
Sept	11.9	2.6	1.2	0.6	0.3	0.0	16.5	1.5

Table 14. CUEs-at-age for lake whitefish from index gillnetting in southern Lake Huron, 1984 - 1986.

Year	Age						Total CUE	Mean Age
	1	2	3	4	5	>5		
1984 Fall	1.7	17.5	0.2	0.0	0.0	0.0	19.4	1.9
1985 Spring	0.0	0.4	20.0	0.7	0.4	0.0	21.5	3.0
1986 Spring	0.0	0.5	0.5	2.4	0.5	0.0	3.9	3.7
Fall	8.2	9.4	8.5	6.3	0.0	0.0	32.5	2.4

Table 15. CUEs-at-age for lake whitefish from index gillnetting at Cape Rich, August 1978 - 1986.

Year	Age						Total CUE	Mean Age
	1	2	3	4	5	>5		
1978	2.54	0.05	0.06	0.21	0.03	0.14	3.06	1.7
1979	0.82	2.70	0.10	0.14	0.02	0.16	3.93	2.1
1980	0.56	2.73	4.25	0.12	0.05	0.09	7.81	2.6
1981	0.10	0.22	0.68	0.46	0.02	0.00	1.49	3.1
1982	0.07	0.73	0.44	0.85	0.37	0.02	2.49	3.3
1983	0.54	0.24	0.22	0.32	0.29	0.07	1.68	3.0
1984	0.07	5.64	0.21	0.65	0.10	0.17	6.84	2.4
1985	0.00	0.25	5.69	0.47	0.50	0.40	7.30	3.4
1986	0.29	0.26	0.95	2.88	0.22	0.33	4.92	3.8

Table 16. CUEs-at-age for lake whitefish from index gillnetting at Blind River, 1981 - 1986.

Year/Month	Age								Total CUE	Mean Age
	0	1	2	3	4	5	6	>6		
1981 July	0.0	0.0	0.7	2.9	4.1	0.7	0.2	0.6	9.2	3.9
Sept/Oct	0.3	0.8	1.2	2.2	2.9	0.3	0.0	0.0	7.7	3.0
1983 June	0.0	2.2	7.9	2.7	1.6	0.5	0.5	0.0	15.4	2.5
1986 July/Aug	0.0	0.0	0.6	3.8	4.6	1.1	0.5	0.0	10.5	3.7

mean age to be greater than at other index locations.

2. Bloater (chub)

Tables 17 to 20 contain the chub CUEs-at-age from index gillnetting at Oliphant, southern Lake Huron and Cape Rich, and trawling at Goderich. As with whitefish, indices of year class strength are presented and discussed later in this report. Bloaters generally do not fully recruit to index gillnets until late summer at age 2, although some indications of cohort magnitude can be obtained by partial recruitment in June at age 2, or at age 1 in southern Georgian Bay. Young-of-the-year chub partially recruit to trawl nets in the fall, but spring yearlings provide the best early indicator of year class strength in trawls.

The Oliphant data (Table 17) illustrate the gradual increase in representation of older age classes resulting from the 1977 and later year classes. Those cohorts produced the recovery of the commercial chub fishery beginning about 1981. Mean age of the index catches from 1981 has not increased because of continued strong recruitment of young age classes and, presumably, reduction of older cohorts to low levels by the fishery. Besides the strong 1977 year class, which began the rebuilding of the chub population, another exceptionally strong year class was produced in 1982, and was still very prominent at age 4 in the 1986 catches.

Index gillnet CUEs-at-age from index gillnets in southern Lake Huron are shown in Table 18. As noted at Oliphant, the 1982 year class was very prominent in the 1984 through spring 1986 catches. In September 1986, fishing was carried out only for lake whitefish, so chub CUEs were understandably much reduced. Even then, the relative catch rates still indicated substantial abundance of age 4 chub. The 1984 year class was also strongly represented in fall 1986. Trawl data (Table 19) similarly showed the 1984 year class to be a strong cohort.

Table 17. CUEs-at-age for chub (bloater) from index gillnetting at Oliphant, 1981 - 1986.

Year/Month	Age									Total CUE	Mean Age
	1	2	3	4	5	6	7	8	9		
1981 June	0.3	7.8	20.1	69.4	4.9	0.6	0.0	0.0	0.1	103.2	3.7
1982 June	0.0	13.7	13.4	21.2	39.2	1.4	0.0	0.0	0.0	88.9	4.0
Sept	0.5	19.1	22.0	37.7	62.1	0.8	0.0	0.0	0.0	142.2	4.0
1983 June	0.0	8.9	48.4	9.4	10.1	13.9	0.5	0.0	0.0	91.2	3.7
Sept	1.4	23.7	37.2	29.0	25.0	24.4	0.1	0.0	0.0	140.8	3.9
1984 June	0.0	19.1	14.2	36.6	19.3	14.2	16.1	0.3	0.0	119.8	4.4
Sept	0.2	145.1	27.3	44.4	19.4	11.8	6.4	0.0	0.0	254.8	3.0
1985 June	0.0	35.3	82.0	34.4	47.6	18.5	10.9	5.5	0.0	234.2	3.9
Sept	0.7	97.5	148.3	21.6	23.2	8.4	6.4	3.4	0.5	310.1	3.1
1986 June	0.0	11.8	40.1	56.2	13.0	15.5	7.3	3.4	0.7	148.1	4.1
Sept	0.0	82.9	65.4	81.7	14.7	13.8	2.1	3.8	0.3	264.7	3.4

Table 18. CUEs-at-age for chub from index gillnetting in southern Lake Huron, 1984 - 1986.

Year	Age									Total CUE	Mean Age
	1	2	3	4	5	6	7	8	>8		
1984 Fall	0.2	218.5	17.8	45.6	19.8	5.9	1.4	0.0	0.0	309.2	2.6
1985 Spring	0.0	14.5	131.7	17.0	20.5	14.8	8.2	2.3	0.1	209.0	3.6
1986 Spring	0.0	1.9	33.8	141.9	30.1	19.4	6.5	1.4	0.5	235.5	4.9
Fall[1]	0.9	30.5	13.2	18.2	0.5	0.0	0.0	0.0	0.0	63.3	2.8

[1](Effort in fall 1986 was directed only at lake whitefish.)

Table 19. CUEs-at-age (no. per 10-minute tow) for bloater (chub) from trawling surveys by USFWS at Goderich, 1981-1986.

Year and season	Age 0	1	2	3	4	5	6	7	8	Total CUE	Mean age
1981 spring	-	4.8	13.7	24.3	73.2	0.0	1.0	0.0	0.0	117.0	3.5
fall[1]	1.0	10.7	6.1	5.4	10.3	0.3	0.3	0.0	0.0	34.1	2.5
1982 spring	-	4.5	33.5	24.7	21.8	32.0	0.0	0.0	0.0	116.5	3.4
fall	37.3	0.8	5.7	3.3	2.8	1.3	0.0	0.0	0.0	50.3	0.8
1983 spring	-	71.8	7.5	29.0	24.2	12.2	17.3	0.0	0.0	162.0	2.7
fall[2]	7.5	303.5	2.7	10.8	0.0	5.4	5.4	0.0	0.0	335.2	1.2
1984 spring	-	40.2	87.8	13.7	17.2	14.7	10.0	5.3	0.4	189.2	2.6
fall	9.5	45.3	196.7	15.5	42.3	18.3	4.2	4.2	0.0	336.0	2.4
1985 spring	-	88.0	17.8	108.8	5.0	19.0	7.7	8.7	0.3	255.3	2.6
fall	3.0	133.0	46.9	62.2	14.0	6.7	2.4	1.1	0.0	269.3	1.9
1986 spring[3]	-	-	-	-	-	-	-	-	-	-	-
fall	0.3	1.8	28.2	23.2	25.7	2.3	1.5	0.7	0.0	83.3	3.1

[1] Fall 1981 CUEs were obtained from age composition percentages from exploratory trawling project (see Dobell 1982) applied to USFWS total CUE.

[2] CUEs for ages 2 to 7 in fall 1983 are imprecise due to small sample sizes, caused by extreme dominance of the subsample by yearling chub.

[3] No trawling done by USFWS in spring 1986.

Table 20. CUEs-at-age for chub from index gillnetting at Cape Rich, 1980 - 1986.

Year	Age						Total CUE	Mean Age
	1	2	3	4	5	>5		
1980	5.10	2.99	1.41	0.08	0.00	0.02	9.61	1.6
1981	0.00	2.27	1.77	0.18	0.00	0.00	4.22	2.5
1982	0.08	7.26	1.07	0.18	0.08	0.00	8.67	2.2
1983	0.00	0.83	0.60	0.23	0.10	0.03	1.79	2.8
1984	1.57	3.42	2.50	1.91	0.14	0.03	9.57	2.6
1985	0.16	54.59	1.15	0.43	0.12	0.00	56.54	2.0
1986	0.00	5.76	23.26	0.69	0.00	0.00	29.71	2.8

Table 21. CUEs-at-age for yellow perch from index gillnetting at Oliphant, 1982 - 1986.

Year/Month	Age						Total CUE	Mean Age
	1	2	3	4	5	>5		
1982 Sept	7.1	133.2	2.7	0.0	0.9	0.9	144.8	2.0
1983 Sept	13.2	114.1	54.2	12.1	0.0	0.0	193.6	2.3
1984 June	0.4	4.9	2.4	0.9	0.4	0.2	9.1	2.6
Sept	37.2	80.9	36.4	1.1	0.0	0.0	155.6	2.0
1985 June	0.0	77.3	16.3	4.6	0.5	0.0	98.7	2.3
Sept	1.9	391.8	7.2	0.3	0.2	0.5	401.9	2.0
1986 June	0.0	0.5	107.0	1.0	1.7	0.0	110.2	3.0
Sept	0.0	74.4	277.3	6.6	0.6	0.4	359.3	2.8

At Cape Rich (Table 20), CUEs for bloater tend to be low because the fishing effort is directed at lake trout backcross, and net sets are centered around water of about 12 C. However, young age classes of bloater are encountered routinely, especially at the deep end of nets set perpendicular to shore. Mean age of the chub catches has remained relatively low because older fish move deeper beyond the range of the fishing effort. The age distributions show moderately good representation of the 1979 and 1980 year classes at ages 1 to 2, and very strong contributions by the 1983 year class at ages 1, 2 and 3.

3. Yellow perch

Perch CUEs-at-age from index gillnetting at Oliphant, southern Lake Huron, Cape Rich, and Clapperton Island (North Channel) are compiled in Tables 21 to 24. In all areas, results indicate a very strong 1983 year class of perch.

For Oliphant (Table 21), June catches from 1981-1983 are not shown because too few perch were caught. The 1985 and 1986 June catches of perch have been sizable only because of the 1983 year class. That cohort also showed strongly as yearlings in September 1984 and dominated the 1984 and 1985 catches. Following that cohort, the 1984 year class is relatively weak, displaying the lowest CUEs at ages 1 and 2 for any year class observed thus far.

In southern Lake Huron (Table 22), the 1981 and 1982 year classes were dominant in the 1984 and 1985 catches, but were outnumbered in 1986 by the newly recruited 1983 cohort. That year class had not recruited earlier to the index gillnets because of slower growth than in other areas (see Appendix D).

The Cape Rich data (Table 23) are characterized by relatively low values, understandable given that the nets are mainly set in colder, deeper

Table 22. CUEs-at-age for yellow perch from index gillnetting in southern Lake Huron, 1984 - 1986.

Year	Age									Total CUE	Mean Age
	1	2	3	4	5	6	7	8	>8		
1984 Fall	0.2	116.1	112.1	5.0	0.5	0.0	0.2	0.0	0.2	234.3	2.5
1985 Spring	0.0	3.8	68.2	88.2	1.7	0.3	0.7	0.7	0.4	164.2	3.6
1986 Spring	0.0	0.0	126.3	65.2	56.3	1.4	0.1	0.1	0.2	249.6	3.7
Fall[1]	0.0	0.0	21.2	19.8	6.8	0.7	0.0	0.0	0.0	48.5	3.7

[1](Effort in fall 1986 was directed only at lake whitefish.)

Table 23. CUEs-at-age for yellow perch from index gillnetting at Cape Rich, 1980 - 1986.

Year	Age							Total CUE	Mean Age
	1	2	3	4	5	6	>6		
1980	0.00	0.20	1.12	0.46	0.29	0.00	0.12	2.20	3.6
1981	0.00	23.75	1.59	0.76	0.10	0.20	0.02	26.41	2.2
1982	0.02	2.54	1.24	0.10	0.00	0.02	0.04	4.00	2.4
1983	0.00	0.00	0.07	1.07	0.00	0.00	0.00	1.15	3.9
1984	23.58	0.82	0.38	0.21	0.65	0.03	0.00	25.67	1.2
1985	0.00	32.78	0.09	0.00	0.06	0.09	0.00	33.03	2.0
1986	0.00	2.81	24.93	0.00	0.00	0.00	0.00	27.74	2.9

Table 24. CUEs-at-age for yellow perch from index gillnetting at Clapperton Island, August 1986.

Age									Total CUE	Mean Age
1	2	3	4	5	6	7	8	9		
23.8	69.2	439.4	80.7	62.9	37.2	8.7	1.1	0.3	723.2	3.3

water than that occupied by perch. The most prominent cohort at Cape Rich has been the 1983 year class, which made a surprising contribution as yearlings and dominated catches at ages 2 and 3 as well.

Although there is no time series yet for index fishing for perch in the North Channel, the 1986 results from the Clapperton Island area did reveal a dominant 1983 year class, as well as a generally high abundance of fish from other cohorts (Table 24).

Abundance of burbot

The most consistent trend in catch rate for any species has been the increasing gillnet CUEs for burbot at Oliphant and Cape Rich (Figure 1). The CUE for burbot has risen 50-fold since 1977 at Cape Rich, and 19-fold since 1982 at Oliphant (CUE was 0 in June 1981). Larval fish data from central Lake Huron showed no increase until 1986, when the catch rate increased from 0.4-4.1 (1978-1985 range) to 43.0 larval burbot per 1000 m^3 (Table 3). In contrast, catches of burbot in southern Lake Huron during 1984-1986 have been negligible.

Potential implications of increased burbot abundance include competition with other predators such as lake trout backcross, predation on newly planted salmonids, and shifting of lamprey attacks from salmonines to burbot. Of 23 burbot netted in Owen Sound bay in spring 1986, 11 were found to contain yearling lake trout and/or backcross stocked 1 to 6 days earlier. Further studies are planned to monitor possible effects of burbot on trout rehabilitation.

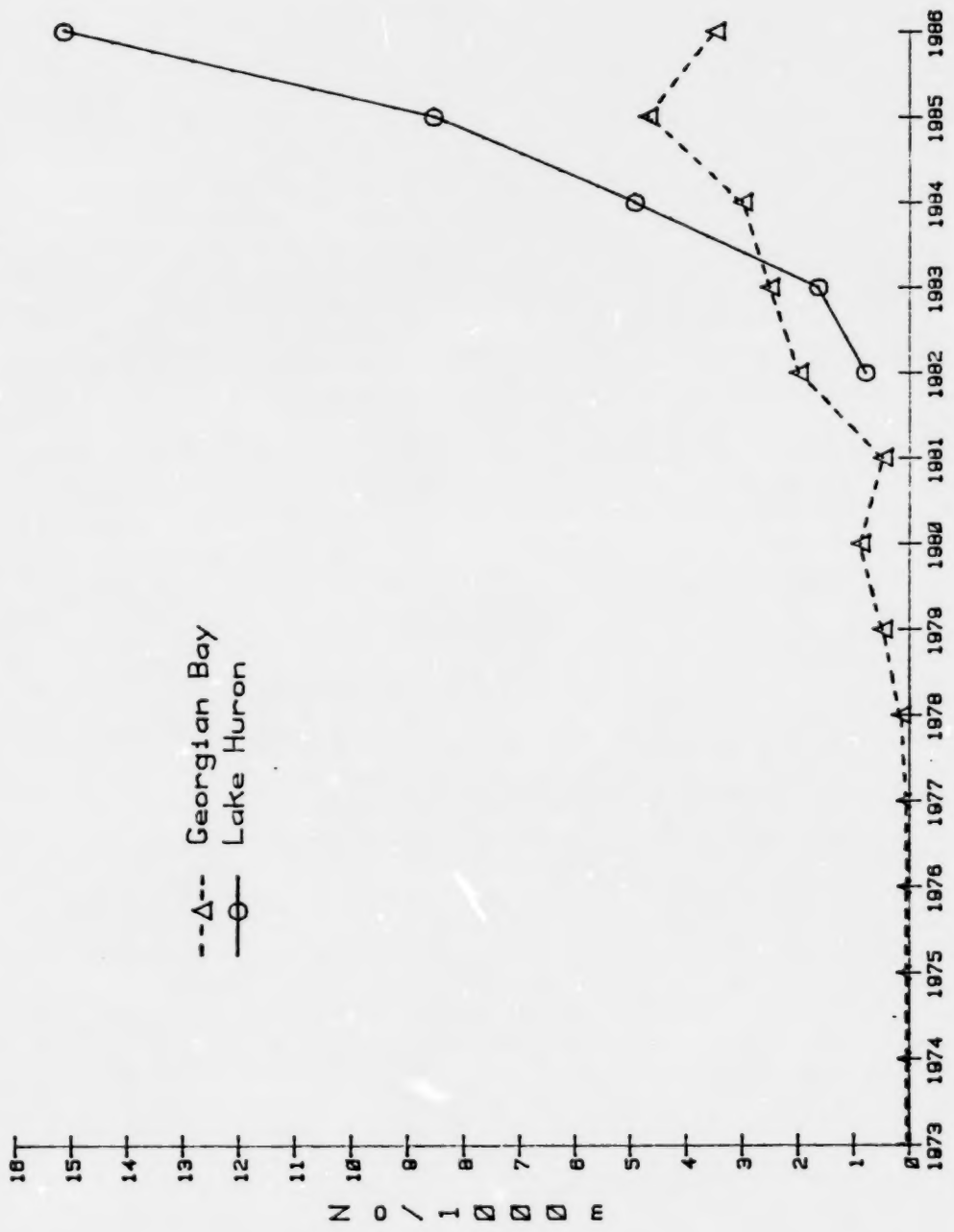


Figure 1. Index gillnetting CUEs for burbot in southern Georgian Bay (1973 - 1986) and central Lake Huron (1982 - 1986).

RECRUITMENT FORECASTS

From the index program alone, only relative indices of recruitment can be generated. By calibrating past indices against actual year class contributions to a fishery (catch-at-age statistics), the indices can eventually be used quantitatively to estimate the numbers or biomass that will recruit. The total supply for a fishery will depend not only on recruitment but also on residual exploitable biomass, estimates of which are obtained from reported harvest and catch sampling data. The section below deals only with trends in relative recruitment, not with overall predictions of fishery quality.

Between-year variability in the catchability of target species in index gillnets precludes direct use of CUEs-at-age as year class indices. Instead, standardized year class indices-at-age are calculated by expressing each cohort's CUE at a given age as a proportion of the average CUE at that age. For each year class, standardized indices (e.g., for ages 1, 2 and 3) are then averaged to yield a single index of its strength. While the effect of year-to-year variability is reduced by this procedure, some bias is incorporated in that a year class is compared only with those year classes from one to three years immediately before or after it. Thus, the earliest and latest cohorts monitored are standardized to different groups of year classes. In time, a single set of five (later ten?) year classes which have largely passed through the fishery will form the standard for comparison. For example, the standard set for whitefish at Oliphant might be the 1980 to 1984 year classes, which could be adopted after 1988 if ages 1 to 4 are included in the averaged indices.

Despite the above problems with the abundance indices, fairly good agreement has been obtained between those indices and estimates of recruitment to the commercial fishery derived from catch-at-age analysis of

the fishery statistics. Improved agreement should be realized as both data series (index fishing and commercial fishery) grow through time.

Lake whitefish

Whitefish year class indices have been calculated for central and southern Lake Huron and southern Georgian Bay. The central Lake Huron indices are plotted in Figure 2, showing generally quite strong production (and little variability) since 1977. Indices for the 1983 and 1984 cohorts are slightly less than those for the 1979-1982 year classes. Recruitment to the commercial fishery is therefore expected to decline slightly in 1987, but the supply of exploitable fish should remain strong due to the previously recruited cohorts.

For southern Lake Huron (Figure 3), the time series is much shorter, so the indices are less precise. Much more contrast between cohorts is evident. The very strong 1982 year class was followed by a much weaker 1983 year class, with increasing production noted for the 1984 and 1985 year classes. (Note that the index for the most recent cohort is always the most imprecise because that cohort has been assessed at only a single age.) A noticeable drop in recruiting fish was forecast for 1986 as a result of the weak 1983 year class.

The southern Georgian Bay indices (Figure 4) show high variability since the mid-1970's, with relatively strong year classes produced in 1977 and 1982. Year classes following the 1982 cohort have been weak in comparison, so recruitment to the commercial fishery is expected to drop in 1987.

No indices are available for North Channel whitefish because the annual index program only began in 1986.

Figure 2. Whitefish indices: central L. Huron

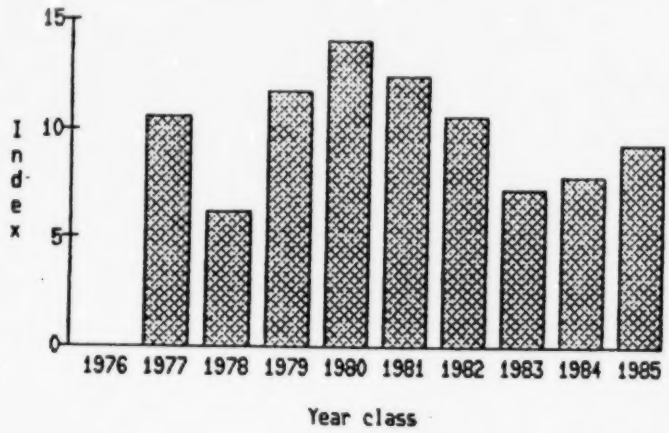


Figure 3. Whitefish indices: southern L. Huron

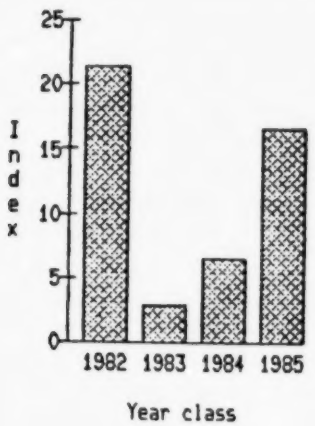


Figure 4. Whitefish indices: southern Georgian Bay

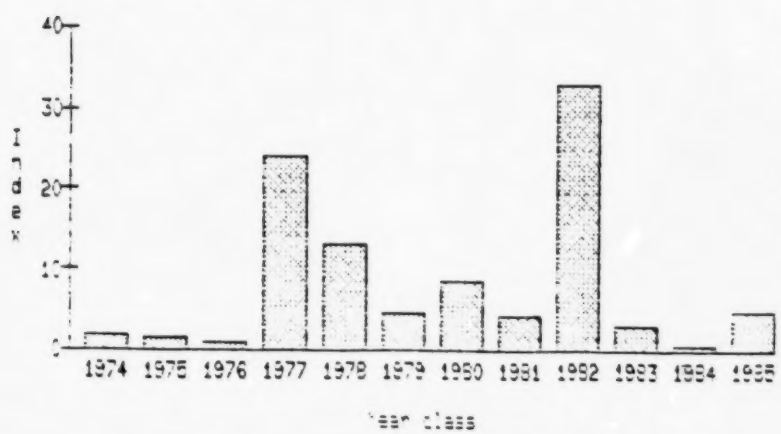


Figure 5. Chub indices: central L. Huron

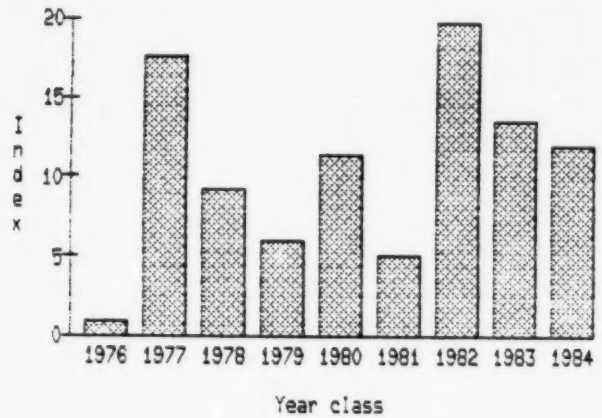


Figure 6. Chub indices (trawl): southern L. Huron

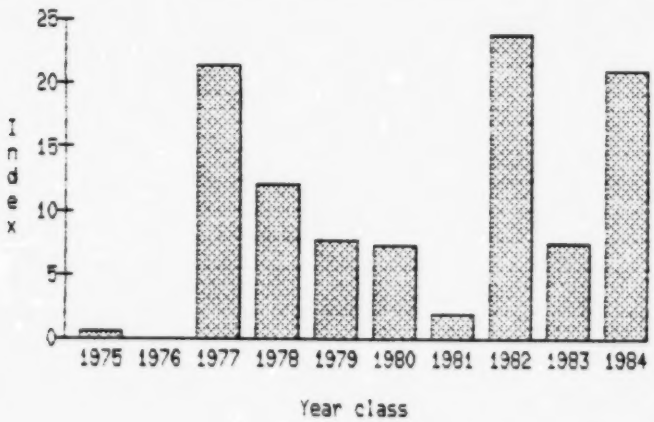
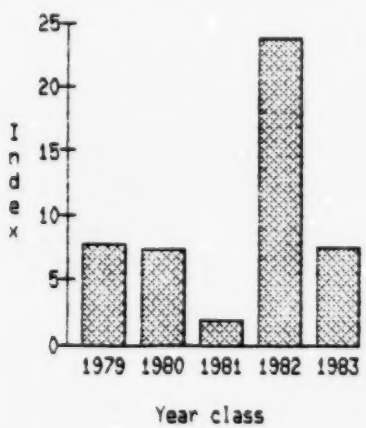


Figure 7. Chub indices (gillnet): southern L. Huron



Chub

Beginning with the 1977 cohort, chub year classes in central Lake Huron have been mainly good to very good (Figure 5). The 1977 and 1982 year classes especially have been strong ones. Ample recruitment to the fishery should continue during 1987.

Two sets of indices are presented for chub in southern Lake Huron, one from trawling by the USFWS at Goderich (Figure 6) and the other from index gillnetting at Grand Bend and Bayfield (Figure 7). The former spans more year classes because that program began in 1981, whereas the gillnet program was initiated in 1984. Trawling also captures younger chub, so more recent cohorts can be monitored. Good agreement is evident between the two sets of indices, with moderate production in 1979, 1980 and 1983, a weak 1981 cohort, and a very strong 1982 year class. The trawl indices also show a strong cohort was produced in 1984. Good recruitment is expected to occur in the fishery in 1987.

The southern Georgian Bay indices (Figure 8) show a different pattern from the main basin chub stocks. Following the mid-1970's collapse of the chub fishery, year class production remained low until 1979 and 1980 when moderately good cohorts were produced. Those were followed by weaker year classes in 1981 and 1982, and a very strong 1983 year class. The latter cohort should contribute to increased recruitment during 1987 and 1988 in southern Georgian Bay.

Yellow perch

The central Lake Huron perch indices, plotted in Figure 9, reveal a 1983 year class at least three times as great as most other cohorts since 1979. That year class had been expected to begin to recruit to the commercial fishery during 1986 (Hughes 1986a); that apparently did occur, because many age 3 fish were caught in 2.5 inch index gillnets in 1986.

Figure 8. Chub indices: southern Georgian Bay

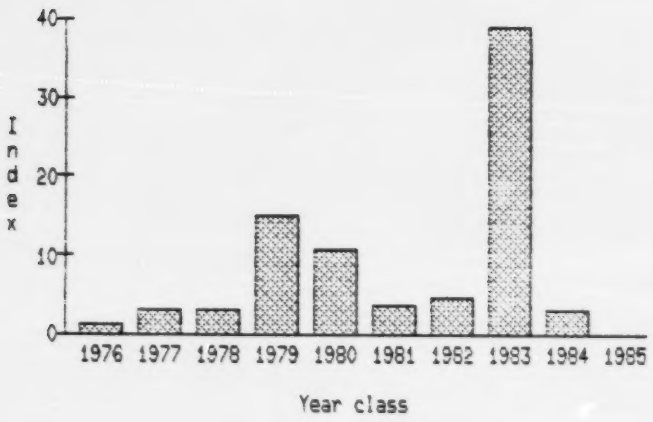


Figure 9. Perch indices: central L. Huron

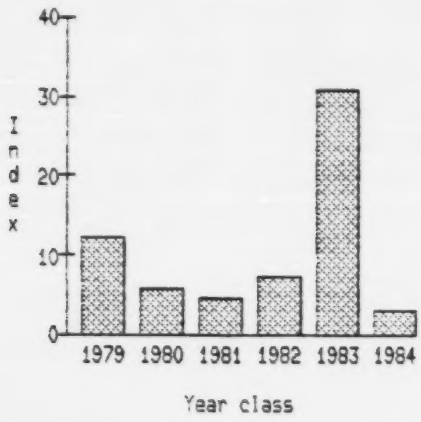
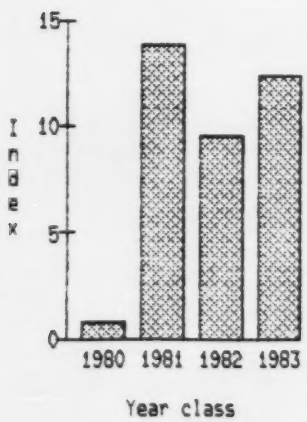


Figure 10. Perch indices: southern L. Huron



Strong recruitment will continue in 1987, followed by a decline resulting from the weak 1984 year class.

Strong year classes of perch were evidently produced in 1981, 1982 and 1983 in southern Lake Huron (Figure 10). Growth is slower there than in central Huron (see Appendix D), likely as a result of the high abundance of small perch. The 1983 cohort may in fact be stronger than the indices suggest because of incomplete recruitment to the index gear. A good supply of recruiting perch is forecast for the 1987 commercial fishery.

High variability in catches of perch in southern Georgian Bay (where fishing effort is directed at lake trout backcross) precludes index calculations for that stock. However, the age distribution (Table 22) clearly indicates a very strong 1983 year class which should benefit the commercial fishery in 1987 following the reduction in minimum mesh size from the previous 2.75 inches (70 mm) for Georgian Bay.

At Clapperton Island in the North Channel, the lack of any time series of data prevents any presentation of year class indices. Table 23 illustrates the high abundance of several cohorts of perch, especially the 1983 year class. Growth is quite slow for that stock, with most four- and five-year-old fish caught in mesh sizes smaller than the (previous) commercial 2.75 inch mesh size. Recruitment will continue strong, particularly after the mid-1987 reduction in minimum mesh size.

SUMMARY

Pre-recruitment year classes of lake whitefish, bloater chub, and yellow perch were monitored during 1986 in central and southern Lake Huron, southern Georgian Bay, and in the central and eastern North Channel, as part of the long-term annual index fishing program of the LHFAU. The program also provides a record of changes in the fish community in the

areas studied. Parts of the index program are primarily directed at following the progress of rehabilitation of lake trout backcross.

Recruitment of whitefish in the central and southern Lake Huron fishery is expected to decline due to weaker 1983 and 1984 cohorts. The 1983 cohort appeared much weaker in the south than in central Huron, but the decrease in recruitment has probably been "smoothed out" by the much more outstanding 1982 year class produced by that stock. Recruitment in the southern Georgian Bay whitefish fishery should also decline in 1987 because of weaker cohorts following a strong 1982 year class.

Chub recruitment in Lake Huron should remain good as a result of strong 1982 and 1984 year classes. In southern Georgian Bay, where the fishery is not as productive at present, improved recruitment should occur in 1987 and 1988 due to the exceptional 1983 year class, followed by a decline as weaker cohorts recruit.

In all perch stocks observed, the 1983 year class is very strong. Increased recruitment from that cohort was/is expected to occur during 1986 and 1987 in central Lake Huron, 1987 and 1988 in southern Lake Huron, and in 1987 and 1988 in the North Channel and southern Georgian Bay. A decrease in recruitment should follow in central Lake Huron by 1988.

The abundance of burbot has steadily increased since 1982 in central Lake Huron and since 1979 in southern Georgian Bay. Fisheries in those and other parts of the lake have been hindered by large catches of burbot in chub gillnets. Further increases in incidental catch rates may occur in Lake Huron, as the 1986 catch of larval burbot was much greater than in previous years. Implications of high burbot abundance for lake trout rehabilitation are being examined.

ACKNOWLEDGEMENTS

Fishing operations and catch sampling (except for North Channel projects) were carried out by Darrell Wilson, Carl Shearer, Gord Toth and Ed deLaPlante on the tug Wonda Goldie. Crews from the Lake Huron Fisheries Research Unit at South Bay conducted the North Channel fishing program on the tug Atigamayg, under the direction of John Novak and John Collins. Thanks are extended to Ray Argyle of the USFWS and the crew of the Grayling for their hospitality in providing access to trawl catches at Goderich.

Sue Salvatori, Maya Chaddah, Todd Bryans and G.T. prepared several thousand scale impressions on acetate slides, and E.d.L. and D.W. performed scale age interpretations. Jim Hastie handled the training and supervision of the technical crews, and audited the data collection. Elaine Philp was responsible for data entry, and system support was provided by Fergus McNeil. Much of the design of the index fishing program (including the method of index calculation), and several improvements in the text of this report, were contributed by Bob Payne, LHFAU supervisor.

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APPENDIX A

Common and scientific names of fishes from index fishing projects.

Common name	Scientific name
sea lamprey	*Petromyzon marinus*
lake sturgeon	*Acipenser fulvescens*
alewife	*Alosa pseudoharengus*
gizzard shad	*Dorosoma cepedianum*
pink salmon	*Oncorhynchus gorbuscha*
coho salmon	*O. kisutch*
chinook salmon	*O. tschawytscha*
rainbow trout	*Salmo gairdneri*
brown trout	*S. trutta*
brook trout	*Salvelinus fontinalis*
lake trout	*S. namaycush*
splake	*S. fontinalis* X *S. namaycush*
lake trout backcross	(*S. fontinalis* X *S. namaycush*) X *S. namaycush*
lake whitefish	*Coregonus clupeaformis*
lake herring	*C. artedii*
bloater	*C. hoyi*
round whitefish	*Prosopium cylindraceum*
rainbow smelt	*Osmerus mordax*
northern pike	*Esox lucius*
longnose sucker	*Catostomus catostomus*
white sucker	*C. commersoni*
redhorse sp.	*Moxostoma* sp.
lake chub	*Couesius plumbeus*
carp	*Cyprinus carpio*
spottail shiner	*Notropis hudsonius*
brown bullhead	*Ictalurus nebulosus*
channel catfish	*I. punctatus*
burbot	*Lota lota*
nine-spine stickleback	*Pungitius pungitius*
trout-perch	*Percopsis omiscomaycus*
white bass	*Morone chrysops*
rock bass	*Ambloplites rupestris*
smallmouth bass	*Micropterus dolomieui*
yellow perch	*Perca flavescens*
walleye	*Stizostedion vitreum vitreum*
freshwater drum	*Aplodinotus grunniens*
sculpin sp.	*Myoxocephalus*/*Cottus* sp.

APPENDIX B

Weekly length distributions of larval fish collected in the Fishing Islands/Stokes Bay area of Lake Huron, 1986.

Table B-1. Weekly length distributions of larval lake whitefish in the Fishing Islands area of Lake Huron, 1986.

Total length (mm)	Date						
	April 21-22	April 29-30	May 6-7	May 13-14	May 20-21	May 27-28	June 3-4
10	3						
11	22	26					
12	39	263	444				
13	9	631	3,410	5			
14		405	6,848	77			
15		5	2,951	199	3		
16			418	155	2		1
17			18	81	5	1	0
18				5	4	1	0
19					0	0	0
20					2	1	0
21					2	0	1
22						1	0
23							0
24							1
25							0
26							0
27							1
Totals:	73	1330	14,089	522	18	4	4

Table B-2. Weekly length distributions of larval lake herring in the Fishing Islands area of Lake Huron, 1986.

Total length (mm)	Date						
	April 21-22	April 29-30	May 6-7	May 13-14	May 20-21	May 27-28	June 3-4
9	1	1	1				
10	0	13	25				
11	5	33	121				
12		31	91	2			
13		8	26	9			
14		3	9	8			
15		1	3	5			
16				4	1		
17				1			
18				1			
Totals:	6	90	276	30	1	0	0

Table B-3. Weekly length distributions of larval yellow perch in the Fishing Islands area of Lake Huron, 1986.

Total length (mm)	Date						
	April 21-22	April 29-30	May 6-7	May 13-14	May 20-21	May 27-28	June 3-4
4				1	1		
5			38	108	59	76	11
6			6	614	224	102	68
7				67	116	52	61
8					74	110	35
9					17	75	28
10					3	38	13
11						8	2
12							1
13							2
Totals:	0	0	44	790	494	461	221

Table B-4. Weekly length distributions of larval burbot in the Fishing Islands area of Lake Huron, 1986.

Total length (mm)	Date						
	April 21-22	April 29-30	May 6-7	May 13-14	May 20-21	May 27-28	June 3-4
3	615	83	2	16	8		
4		1		73	137	4	12
5				1	7	3	1
6					2		
Totals:	615	84	2	90	154	7	13

Table B-5. Weekly length distributions of larval rainbow smelt in the Fishing Islands area of Lake Huron, 1986.

Total length (mm)	Date						
	April 21-22	April 29-30	May 6-7	May 13-14	May 20-21	May 27-28	June 3-4
4					1		
5					14		
6					29	1	1
7					5	1	0
8						1	0
9						0	1
10						0	
11						0	
12						1	
Totals:	0	0	0	0	49	4	2

APPENDIX C

Catches by mesh size in index gillnetting projects, 1986

Table C-1. Catch by mesh size from index gillnetting at Oliphant, June 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		99	4					1		104
chinook salmon						1				1
lake trout				1						1
lake whitefish		1	2	10	10	16	13	9	7	68
lake herring			4	6	3	2				15
bloater		143	268	74	13	2	2	2	3	507
cisco sp.		3								3
round whitefish			3	6	5	3		1		18
rainbow smelt			2		1		1			4
longnose sucker			6	16	12	24	8	5		71
white sucker							1			1
burbot		5	1	16	25	20	10	5	4	86
yellow perch		185	249	18	5	2	1			460
Totals:		436	539	147	74	70	36	23	14	1339

Table C-2. Catch by mesh size from index gillnetting at Oliphant, September 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		211	35	3	1	1			2	253
gizzard shad								1		1
chinook salmon			2						1	3
lake whitefish		4	78	9	12	2	5	5	2	117
lake herring			2	1		1			1	5
bloater		530	404	58	7	9	3	4	4	1019
cisco sp.			1							1
round whitefish		1	11	9	9	2	3			35
rainbow smelt		53	89	79	56	24	14	13	11	339
longnose sucker			15	55	42	7	17	4	2	142
white sucker			1			2	6	2	1	12
lake chub		9								9
channel catfish				1	1					2
burbot		5	6	44	69	93	51	12	8	288
rock bass			1							1
yellow perch		346	847	281	18	2				1494
TOTAL:		1159	1492	540	215	143	99	41	32	3721

Table C-3. Catch by mesh size from index gillnetting in southern Lake Huron, June 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		24	3							27
coho salmon				1		1				2
chinook salmon				1	2	1			1	5
lake trout			2	1	1					4
lake whitefish				2	3	2	7	6	3	23
lake herring				1						1
bloater		720	519	33	29	13	17	12	4	1347
rainbow smelt		10	22	12	33	16	10	8	1	112
longnose sucker				1	2	9	6	6	1	25
white sucker						6	6	4	1	17
burbot		1				3	1			5
yellow perch		832	502	17	3	3	1	1		1359
Totals:		1587	1048	69	73	54	48	37	11	2927

Table C-4. Catch by mesh size from index gillnetting in southern Lake Huron, September 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		6	12							18
gizzard shad					3	5	3	4	7	22
chinook salmon		1	8	12	1				1	23
lake trout		1	1		2					4
lake whitefish			20	32	23	31	37	31	16	190
bloater		52	35					2		89
round whitefish				1						1
rainbow smelt		99	212	190	145	127	93	76	60	1002
white sucker								1	1	2
yellow perch		3	49	12	3	1				68
walleye					2	2	1			5
Totals:		162	337	247	179	166	134	114	85	1424

Table C-5. Catch by mesh size in index gillnets at Blind River, July-August 1986.

Species	Mesh size mm:	25	38	51	64	76	89	102	114	127	Total
	in:	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		19	139	3	1	3	2				167
chinook salmon			1	1							2
backcross					1						1
lake whitefish				3	7	12	18	16	7	6	69
lake herring				1	2	2		1			6
cisco sp.		86	37	2							125
round whitefish			5	35	68	51	11	3			173
rainbow smelt		26	12	20	18	11	12	2	2	2	105
longnose sucker				4		1	1				6
white sucker						1					1
burbot								1		1	2
Totals:		131	194	69	97	81	44	23	9	9	657

Table C-6. Catch by mesh size in index gillnets at Clapperton I., August 1986.

Species	Mesh size mm:	25	38	51	64	76	Total
	in:	1.0	1.5	2.0	2.5	3.0	
lake sturgeon						1	1
alewife		6	8	1			15
cisco sp.		1					1
rainbow smelt		30	23	23	45	18	139
northern pike					1		1
white sucker			2	7	42	95	146
lake chub		10	3				13
spottail shiner		255	1				256
brown bullhead						1	1
trout-perch		46	1				47
rock bass		1	3	5	1	1	11
yellow perch		97	675	964	117	20	1873
sculpin sp.		1					1
Totals:		447	716	1000	206	136	2505

Table C-7. Catch by mesh size in index gillnets at Heywood Island, August 1986.

Species	Mesh size mm:	25	32	38	44	51	57	64	70	76	89	102	114	127	Total
	in:	1.0	1.25	1.5	1.75	2.0	2.25	2.5	2.75	3.0	3.5	4.0	4.5	5.0	
alewife		32	90	111	17	2	3	1		3	1	2		2	264
backcross		1	3	6	12	51	67	63	52	45	30	29	15	6	380
lake herring					2	1	6	8	6	5	1	3			32
cisco sp.		174	557	373	122	102	38	14	10	4	1		1	1	1397
round whitefish		1		2	4	10	15	21	12	4	1	1			71
rainbow smelt		198	146	171	168	355	291	220	97	73	57	13	11	14	1814
longnose sucker						3	5	5	6	7	4	3			33
white sucker					1				2	7	25	21	14	5	75
yellow perch				1		4	8	2							15
sculpin sp.		1	1										2		4
Totals:		407	797	664	326	528	433	334	185	148	120	72	43	28	4085

Table C-8. Total catch by mesh size from index gillnetting at Cape Rich, August 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
sea lamprey			1		1		1		1	4
alewife		46	28							74
chinook salmon		22	7	1	3	1	1	1		36
rainbow trout		4	2	1						7
backcross		121	295	265	247	267	269	240	210	1914
lake whitefish		1	8	5	9	17	33	25	36	134
bloater		316	129	13	14	10	7	7	3	499
round whitefish		3	3	5	1	2				14
rainbow smelt		148	305	278	227	151	78	46	38	1271
longnose sucker		6	39	72	108	147	41	4	2	419
white sucker		18	223	429	559	390	40	2	1	1662
lake chub		35								35
burbot		1	4	7	16	17	21	19	11	96
yellow perch		222	308	8	1					539
Totals:		943	1353	1085	1186	1002	491	344	302	6706

Table C-9. Total catch by mesh size from index gillnetting in Owen Sound bay, August 1986.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
alewife		254	13		1					268
chinook salmon		1	6			1		1		9
rainbow trout			1							1
brown trout			1				2			3
lake trout		1								1
backcross		40	106	143	136	101	110	96	94	826
lake trout sp.		1								1
lake whitefish			2		3	2	4	4	10	25
bloater		336	202	15	14	7	3	3	2	582
round whitefish			1	3	1					5
rainbow smelt		72	201	156	96	59	44	35	11	674
longnose sucker		4	36	55	89	132	36	4	1	357
white sucker		1	11	36	75	105	14	1		243
lake chub		9		1						10
burbot		2	16	58	55	79	55	23	13	301
yellow perch		334	175	7	1					517
Totals:		1055	771	474	471	486	268	167	131	3823

APPENDIX D

Size-at-age summaries for lake whitefish, bloater and yellow perch from index fishing projects, 1986.

Table D-1. Mean fork lengths (mm) at age for lake whitefish from index gillnetting projects in Lake Huron and Georgian Bay, 1986.

Project	Age								
	1	2	3	4	5	6	7	8	13
CENTRAL L. HURON									
Oliphant (June)									
Mean F.L.:	196	274	342	420	483	526			
(n):	(1)	(13)	(25)	(22)	(5)	(2)			
Oliphant (Sept)									
Mean F.L.:	220	304	373	432	479				
(n):	(83)	(19)	(9)	(4)	(2)				
SOUTHERN L. HURON									
Grand Bend (June)									
Mean F.L.:		291	366	446	432				
(n):		(3)	(3)	(14)	(3)				
Grand Bend (Sept)									
Mean F.L.:	245	345	415	459					
(n):	(48)	(55)	(50)	(37)					
SOUTHERN GEORGIAN BAY									
Cape Rich (August)									
Mean F.L.:	216	310	395	497	515	554		618	664
(n):	(7)	(7)	(26)	(79)	(6)	(5)		(3)	(1)
Owen Sound (August)									
Mean F.L.:	240	370	474	508	535	584			
(n):	(1)	(2)	(14)	(4)	(1)	(2)			
NORTH CHANNEL									
Blind R. (Aug)									
Mean F.L.:		284	366	425	461	509			
(n):		(4)	(24)	(30)	(6)	(3)			

Table D-2. Mean fork lengths (mm) at age for bloater chub from index gillnetting and trawling projects in Lake Huron and Georgian Bay, 1986.

Project	Age											
	1	2	3	4	5	6	7	8	9	10	11	12
CENTRAL L. HURON												
Oliphant (June)												
Mean F.L.:		157	189	211	229	234	239	240	251			
(n):		(29)	(105)	(190)	(48)	(60)	(29)	(15)	(3)			
Oliphant (Sept)												
Mean F.L.:		169	196	216	226	234	242	238	259			
(n):		(130)	(129)	(212)	(48)	(50)	(10)	(13)	(2)			
SOUTHERN L. HURON												
Grand Bend (June)												
Mean F.L.:		156	182	202	225	235	245	251	261			
(n):		(8)	(116)	(563)	(159)	(114)	(41)	(10)	(3)			
Grand Bend (Sept)												
Mean F.L.:	150	179	199	223	224							
(n):	(1)	(34)	(18)	(34)	(1)							
Goderich (Oct)												
Mean F.L.:	139	160	182	195	222	215	226					
(n):	(1)	(84)	(64)	(65)	(7)	(4)	(2)					
SOUTHERN GEORGIAN BAY												
Cape Rich (August)												
Mean F.L.:		175	199	209								
(n):		(84)	(396)	(12)								
Owen Sound (August)												
Mean F.L.:		176	202	231	258	284	277					
(n):		(21)	(344)	(24)	(14)	(11)	(1)					
NORTH CHANNEL												
Heywood I. (Aug)												
Mean F.L.:	135	168	183	221	239	252	263	280	309	325	316	389
(n):	(2)	(89)	(215)	(25)	(42)	(32)	(22)	(9)	(4)	(1)	(1)	(1)

Table D-3. Mean fork lengths (mm) at age for yellow perch from index gillnetting projects in Lake Huron and Georgian Bay, 1986.

Project	Age									
	1	2	3	4	5	6	7	8	9	10
CENTRAL L. HURON										
Oliphant (June)										
Mean F.L.:		138	180	192	239					
(n):		(1)	(284)	(3)	(7)					
Oliphant (Sept)										
Mean F.L.:		154	211	239	305	290	319			
(n):		(98)	(516)	(17)	(3)	(1)	(1)			
SOUTHERN L. HURON										
Grand Bend (June)										
Mean F.L.:			148	170	185	243	325	314		333
(n):			(278)	(212)	(280)	(8)	(1)	(1)		(1)
Grand Bend (Sept)										
Mean F.L.:			188	205	230	304				
(n):			(29)	(28)	(10)	(1)				
SOUTHERN GEORGIAN BAY										
Cape Rich (August)										
Mean F.L.:			160	180						
(n):			(21)	(216)						
Owen Sound (August)										
Mean F.L.:				178						
(n):				(214)						
NORTH CHANNEL										
Clapperton I.(Aug)										
Mean F.L.:	105	146	180	199	220	231	257	260	254	
(n):	(37)	(78)	(525)	(114)	(123)	(82)	(25)	(3)	(1)	